Pervaporation performance of crosslinked PVA and chitosan membranes for dehydration of caprolactam solution

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ABSTRACT

e-caprolactam (CPL) is the monomer of nylon-6 used extensively in the manufacture of high quality nylon-6 fibers and resins. But high energy consumption, high wastage and condensate pollution have restricted the wide-scale production of CPL and the commercial profit of this process. To improve a new dehydration process, pervaporation separation of CPL solution was investigated using composite membranes. The selective layer was formed with poly(vinyl alcohol) and chitosan matrix through the cross-linking reaction with glutaraldehyde. Films were characterized by scanning electron microscope (SEM), Fourier transform-infrared (FT-IR) and X-ray diffraction (XRD). The pervaporation results have revealed that separation performances of CS/PVA composite membranes are strongly related to the ratio between PVA and CS as well as its hydrophilic nature and the operating parameters. The membrane of the ratio (CS/PVA = 1:3) exhibited the most conformable separation performance with a total flux of 757 g/(m² h) and separation factor of 443 at 50°C for 50 wt% CPL aqueous solution. Data showed that the composite membranes had superior separation performances for dehydration of CPL solution, which provided a new way for CPL dehydration.

Keywords: e-caprolactam; Pervaporation; Poly(vinyl alcohol); Chitosan; Cross-linking

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